Registration no: | | | | | | | | | | |

Total Number of Pages: 03 **B.TECH**

PEME5401

7th Semester Regular / Back Examination 2015-16

MECHANICAL VIBRATION

BRANCH: MECH

Time: 3 Hours

Max marks: 70

Q.CODE: T357

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

a) State and explain D' Alemberts Principle and its significance.

b) A helical coil spring is made from a steel wire of diameter 12mm. The spring Has a coil diameter of 60mm and has 45 active coils. Find the stiffness of the spring. What will be the change in length of spring if one end of spring is fixed and weight of 100kg is attached at the other end? G for steel=8×10^9 N/m^2

c) The natural frequency of spring-mass system is 10Hz. When the spring stiffness is reduced by 800N/m, the frequency is altered by 50%. Find the mass and stiffness of the original system.

d) Give the comparison between viscous damping and produce the diagram.

e) What is Logarithmic decrement? Explain through diagram and its significance for vibration.

f) What is magnification factor? Explain through graphical forms and its importance.

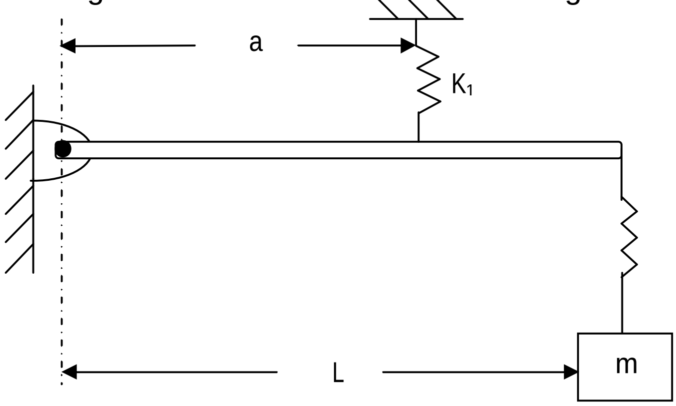
g) What is Transmissibility? Explain through diagrams and draw the corresponding graph.

h) Explain sharpness of resonance and derive it and show in the graphical form.

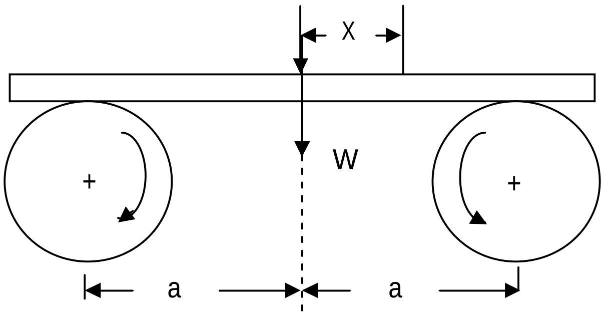
i) What is degree of freedom in vibrating system? Explain the modes of vibrations.

j) Define co-ordinate coupling and explain static and dynamic coupling through diagram.

Q2 **a)** A rigid mass less bar of length 'l' is hinged at its left end and carries a spring K_2 with mass 'm' at free end. The bar is also supported by a spring K_1 at a distance 'a' from the left hinge. Determine the natural frequency of the bar, for the angular oscillation 'ϴ' as shown the figure below. **(5)**



b) For determining the coefficient of dry friction, the device is shown in the figure. A bar rests on two equal disks rotating with equal speed in opposite direction. If the bar is displaced from the position equilibrium and released, it performs harmonic oscillations by moving back and forth about its axis. Determine an expression for the coefficient of dry friction in terms of the natural frequency. **(5)**



Q3 a) A spring mass damper system is defined by following parameter m=3kg, K=100N/m, C=3 N-s/m. **(5)**

Determine: i) Critical damping constant.

ii) Damping ratio

iii) Frequency of damped oscillation

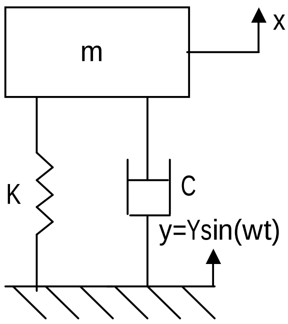
iv) Logarithmic decrement

v) No of cycles after which the initial amplitude is reduced to 20%.

b) A 50kg mass is attached to a base through a spring and dashpot as shown in figure and the base undergoes a harmonic excitation of y=0.2 Sin30t. The spring has stiffness value of 3×10^4 N/m and the dashpot constant is 200N-s/m. Determine: **(5)**

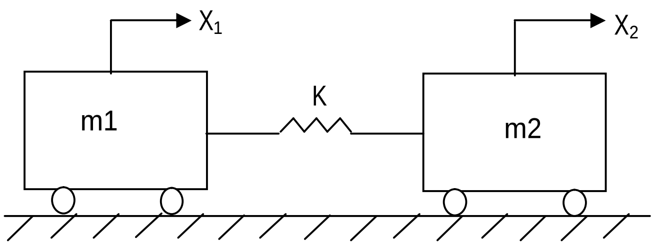
(i) Relative displacement of the mass

(ii) Absolute displacement of the mass



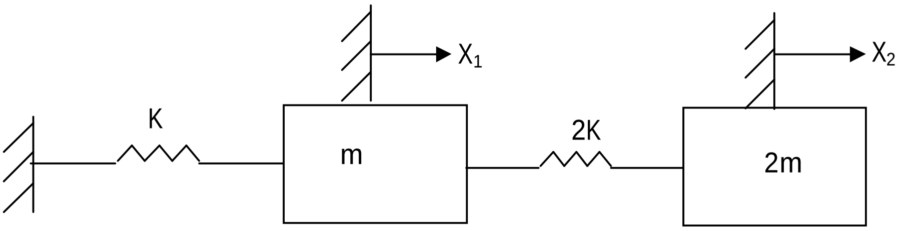
Q4 a) A rotating machine of mass 650kg, operating at a constant speed of 1500rpm, has an unbalance of 0.12kg-m. If the damping in the isolation is given by damping ratio of ε = 0.08, determine stiffness of the isolators so that the transmissibility at the operating speed is less than or equal to 0.15. Determine also the magnitude of the force transmitted. **(5)**

b) Find out the equation of motion, amplitude ratios, its natural frequencies and justify the system as shown in figure. **(5)**

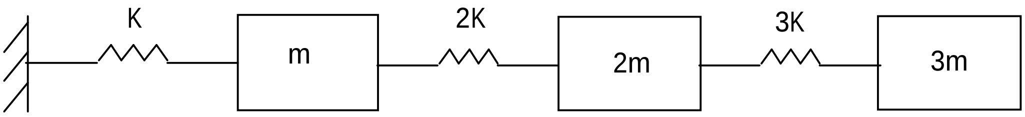


Q5 **a)** Draw the vector relationship diagram in forced vibration under the ratio of $\frac{w}{w_n} \ll 1, \frac{w}{w_n} = 1, \frac{w}{w_n} \gg 1$ and explain. **(5)**

b) Find the natural frequencies, amplitude ratios and mode shapes of the system as shown in the figure. **(5)**

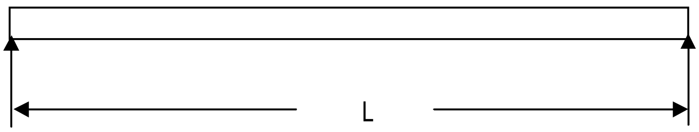


Q6 Determine the lowest frequency and corresponding principal mode of vibration of the system as shown in figure using method of matrix iteration. **(10)**

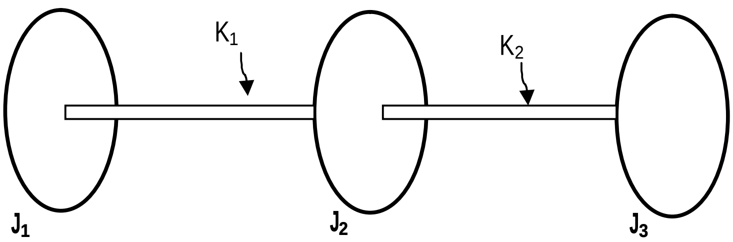


Q7 **a)** Define and explain discrete system and continuous system through diagram. **(2)**

b) Find the natural frequencies and mode shapes for the transverse vibration of a beam simply supported at both the ends as shown figure. **(8)**



Q8 **a)** Determine the natural frequencies and mode shape of the system as shown in figure by using Holzer's method. **(5)**



$K_1=0.10\times10^6$ Nm/rad, $K_2=0.20\times10^6$ Nm/rad
$J_1=5.0$ kg.m^2, $J_2=11.0$ kg.m^2, $J_3=22.0$ kg.m^2

b) Determine the natural frequencies of vibration of uniform beam clamped at one end and free at the other end. **(5)**